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Background: Heart failure affects more than 6 million Americans and an estimated 23 million people worldwide. Inadequate self-care is associated with readmissions and are identified as a marker for poor health outcomes. Nurse-led heart failure inpatient hospital education has been demonstrated to improve knowledge, self-care behaviors and in some studies to reduce 30-day readmissions.

Aims/Objectives: To evaluate the impact of nurse-led heart failure patient education on knowledge, self-care behaviors, and all cause 30-day hospital readmission.

Design: Quasi-experimental pre-test and post-test on a convenient sample on two cardiac units at a large urban facility in the North East region of the United States.

Methods: An evidence-based standardized heart failure patient education program based on the American Colleges of Cardiology and American Heart Association guidelines was implemented with a telephone follow-up at 7, 30, and 90 days post-discharge. The duration of the study was from September 2015 to February 2016. A convenience sample of ($N = 29$) individuals diagnosed with heart failure was asked to complete Dutch Heart Failure Knowledge Scale and Self-care Heart Failure Index.

Results: A significant difference was found in knowledge at 7 day ($P \le .001$) and 90 day ($P \le .032$), self-care maintenance at 7 day ($P \le .000$) and 30 day ($P \le .000$), self-care management at 7 day ($P \le .001$) and 30-day ($P \le .013$). A statistically significant difference was found in self-care confidence at 30-day ($P \le .017$) but not at 7 day follow-up call. A statistically significant improvement in 30-day readmission was not found ($P \ge .05$).

Conclusion: Findings suggest the importance of developing patient education programs that are focused on improving knowledge and self-care behaviors for heart failure patients. Nurses are uniquely qualified to implement such programs that can improve health outcomes and need to accommodate evidence-based recommendations to global practice settings.

Keywords: heart failure; patient readmission; knowledge; self-care; nurse-led education; readmission

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Introduction

It is estimated that 23 million individuals are living with heart failure worldwide (Baptiste et al., 2016). Approximately 5.8 million Americans have a diagnosis of heart failure and has reached a national epidemic in the United States (Boisvert et al., 2015; Centers for Disease Control and Prevention [CDC], 2019; Hart, Spiva, & Kimble, 2011; Sterne, Grossman, Migliardi, & Swallow, 2014; Wang, Lin, Lee, & Wu, 2011). Heart failure (HF) is the most common cause of hospital readmission (Sterne et al., 2014). Studies show that nearly 24% are readmitted within 30 days and 30% of heart failure patients are readmitted within 60–90 days (Askren-Gonzalez & Frater, 2012; Dharmarajan et al., 2013; Paul & Hice, 2014). Furthermore, 27% of Medicare recipients with HF are readmitted within 30-days (Albert, 2012; Hart et al., 2011; Sterne et al., 2014; Wang et al., 2011; Yancy et al., 2013). The Centers for Medicare and Medicaid Services (CMS) defines readmission as an unplanned re-hospitalization for any cause to an acute care hospital within 30 days of discharge (Baptiste et al., 2016; Dennison et al., 2011). Frequent readmission is a financial burden on patients, their families, and health care systems (Toback & Clark, 2017). The cost of treating heart failure, including lost wages and lost productivity in the United States is estimated at $32 billion per year (CDC, 2019; Hart et al., 2011; Paul & Hice, 2014; Yancy et al., 2017).

Hospital readmissions are associated with poor health outcomes. Dharmarajan et al. (2013) reported that readmission within 30-days is the most vulnerable period for individuals with heart failure. Hospital readmissions are commonly attributed to factors such as, individuals' lack of knowledge about disease processes, inadequate symptom recognition, and inability to make prompt and appropriate decisions to manage symptoms, and the absence of timely follow-up with a health care provider (Askren-Gonzalez & Frater, 2012; Dennison et al., 2011; Dracup et al., 2012; Spaling, Currie, Strachan, Harkness, & Clark, 2015; Paul & Hice, 2014). For patients with heart failure, the level of knowledge about disease process is positively correlated with the ability to recognize and manage symptoms as they arise, therefore initial assessment of patient's knowledge and self-care behaviors by nurses prior to engaging in patient education is essential to provide an appropriate patient education (Albert, 2012; Riegel et al., 2009).

Nurse-led heart failure inpatient hospital education has been demonstrated to improve knowledge, self-care behaviors and in some studies to reduce 30-day readmissions (Albert, 2012; Domingues, Clausell, Aliti, Dominguez, & Rabelo, 2011; Kommuri, Johnson, & Koelling, 2012; Paul & Hice, 2014; Yancy et al., 2013). In 2017, the American Colleges of Cardiology Foundation (ACCF) and American Heart Association (AHA) updated the 2013 practice guidelines for the management of heart failure, focused on most effective strategies for improving the quality of care, resources, and patient outcomes (Yancy et al., 2013). ACCF/AHA best practice guidelines recommend a one-to-one nurse-led HF education encompassing diet, activity, weight monitoring, smoking cessation, fluid restriction, medication adherence, keeping follow-up appointments and a reduction in hospitalizations. (Albert, 2012; Sterne et al., 2014; Yancy et al., 2013; Yancy et al., 2017). The ACCF/AHA guidelines recommend one-on-one nurse-led education by specialist nurses who can promote adherence to treatments and healthy lifestyles for individuals with heart failure. Improving knowledge about signs and symptoms of disease progression, treatment plan, and actions to engage in to manage symptoms has been reported to minimize exacerbation and frequent hospitalization (Suk Lee et al., 2015; van der Wal, Jaarsma, Moser, & van Veldhuisen, 2005). The purpose of this study was to implement a standardized nurse-led heart failure education program focused on improving knowledge and self-care behaviors for individuals living with heart failure.

Methods

Design, setting, participants

A quasi-experimental study, using pre-test and post-test implemented on a convenient sample on two cardiac units at a large urban facility in the North East region. The principal investigator (PI) screened charts for a primary and/or secondary diagnosis of heart failure and eligibility. The PI then approached eligible patients to obtain verbal consent for participation. The inclusion criteria for eligibility were: (1) All heart failure patients admitted to the two cardiac units, (2) patients discharge destination is to home, (3) patients are able to give written or verbal consent for themselves, (4) patients equal to and older than 18 years old, and (5) patient who speak English. Exclusion criteria were: (1) patients younger than 18 years old, (2) non-English speaking, (3) patients unable to provide informed consent, (4) patients not discharged to home, and (5) patients not admitted to the two cardiovascular units. Eligible patients who agreed to participate were given a baseline knowledge and self-care behavior assessment using validated tools: Dutch Heart Failure Knowledge Scale and Self-care Heart Failure Index. Then participants were engaged in a one-on-one nurse-led heart failure education by the PI and reinforced by the unit nurses. Participants were provided with a visual color-coded (Green, Yellow, and Red) guide to monitor symptoms and actions they should take based on the symptom that corresponded with the color (Figure 1).

The evidence-based standardized heart failure patient education program was implemented with telephone follow-up at 7, 30, and 90 days post-discharge. Individuals ($N = 29$) diagnosed with heart failure were asked to complete Dutch Heart Failure Knowledge Scale (DHFKS) and Self-care Heart Failure Index (SCHFI) prior to hospital discharge. The DHFKS scores were evaluated during the pre-intervention period, then at 7 and 90 days after hospital discharge. SCHFI questionnaires were distributed to participants at the pre-intervention time period, with a follow-up at 7 and 30 days after hospital discharge. Staff nurses of both cardiac units were asked to complete a Conviction and Confidence scale prior to initiating patient education (Agency for Healthcare Research and Quality, 2015; Xu, 2012). Power analysis for a dependent sample t-test was conducted to determine a sufficient sample size using an alpha of 0.05, a power of 0.80 (Liou et al., 2015; Sterne et al., 2014). Based on the previous studies conducted by Liou
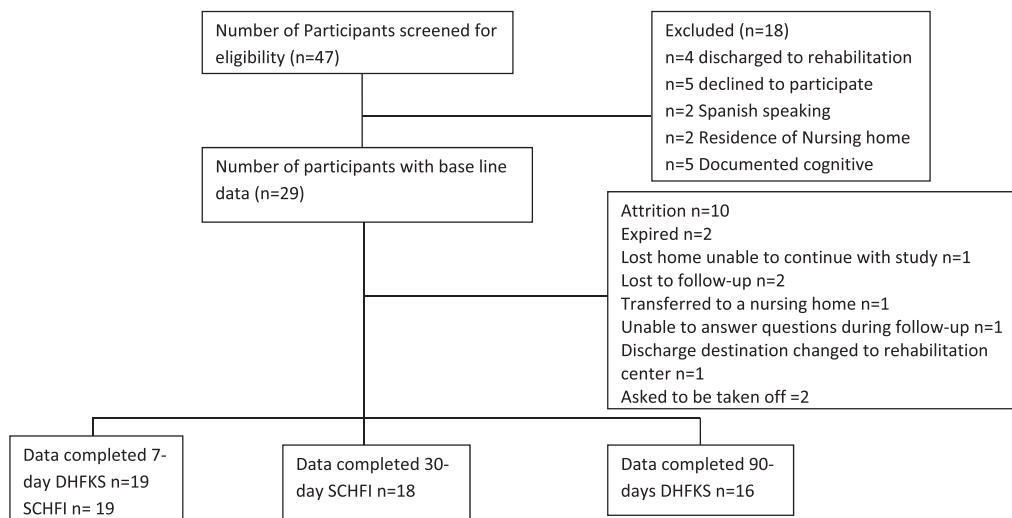

Figure 1.   Study diagram.

et al. (2015), and Dennison et al. (2011) the desired sample size to produce a change in scores for DHFKS was $N = 6$, and SCHFI was $N = 16$.

Prior to patient education, nurses on the two cardiac units were provided with a one-hour training during a lunch and learn sessions for three consecutive days on each clinical unit. Education sessions for the nurses were carried out across six days. To promote understanding and consistency, nurses were asked to recapitulate the content in their own words and use the Robert Woods Johnson Foundation's (RWJF) *Living with Heart Failure: A patient Teaching Guide.* Content for the RWJF standardized heart failure patient education materials are based on the ACCF/AHA guidelines addressing diet, activity, weight monitoring, smoking cessation, fluid restriction, medication adherence, and keeping follow-up appointments (Robert Woods Johnson Foundation, 2011). Participants were then engaged in a one-to-one nurse-led heart failure education by the PI and received daily follow-up education sessions with staff nurses. Nurses provided two, one-to-one education sessions to participants during hospitalization over 30 minutes, using the RWJF standardized heart failure instructional materials. The education program was implemented with a telephone follow-up at 7, 30, and 90 days post-discharge. The duration of the study was from September 2015 to February 2016. Participants were provided with a visual color coded (Green, Yellow, and Red) self-care guide to monitor symptoms and actions they should take based on the symptom that corresponded with the color (Figure 2).

Participants were contacted via telephone by the PI at 7 days, 30-days and 90-days after hospital discharge. During the follow-up period, participants were asked to complete the SCHFI and DHFKS questionnaires at different points in time. A follow-up call was made at 7 and 30-days after hospitalization to complete SCHFI, and at 7 and 90-days to complete DHFKS questionnaire. In addition, participants were evaluated for readmission, 30-days after hospital discharge.

In this study the PI identified three outcomes. The primary outcome was to improve knowledge and measure it using a validated and reliable instrument, the Dutch Heart Failure Index (van der Wal, et al., 2005). The second outcome was to improve self-care maintenance, self-care management, and self-care confidence using a validated and reliable instrument, Self-Care Heart Failure Index (Barbaranelli, Lee, Vellone, & Riegel, 2014; Riegel et al., 2009). The Dutch Heart Failure Knowledge scale (DHFKS) is a 15-item instrument that measures the individual's general knowledge about heart failure (van der Wal et al., 2005). The Self-care Heart Failure Index (SCHFI) is a 22-item instrument that measures self-care behaviors using three subscales: self-care maintenance, self-care management, and self-care confidence (Barbaranelli et al., 2014). The third outcome was to reduce 30-day all cause readmissions. The investigators also examined the nurses' ease of using teach-back method during patient education with the Confidence and Conviction Scale tool (Xu, 2012). The Confidence and Conviction scale is a 4-item instrument that evaluates beliefs about the importance of using teach-back method and confidence during patient education. Teach-back method, also known as 'show me', provides insight into the level of patient's understanding of the instruction provided by the health care provider by prompting the patient to reiterate what they have learned in their own words (Dinh, Bonner, Clark, Ramsbotham, & Hines, 2016). This method is frequently used in clinical settings when providing patient education. The main goal of teach-back is to have the learner demonstrate their knowledge by repeating back what they are taught (Dinh et al., 2016).

Theoretical framework

Caring for individuals with heart failure is unique and challenging. The study was conducted at the large urban teaching hospital where the population served came from a diverse cultural, socio-economic, and educational backgrounds. This study drew on the Theory of Culture Care &

ZONES TO MANAGE HEART FAILURE

Discharge Weight: _____   Doctor's Name: _____

First weight at home: _____   Doctor's Phone: _____

	You have:	What to do:
GREEN ZONE	♥ No shortness of breath ♥ No weight gain more than 3 pounds per day ♥ No swelling of feet, ankles, legs or stomach ♥ No chest pain	♥ Keep up the good work! ♥ Take your medicine ♥ Eat a low salt diet ♥ Weigh yourself every day
YELLOW ZONE	♥ Weight gain of 3 pounds in 1 day or 5 pounds in one week ♥ More shortness of breath ♥ More swelling in your feet, ankles, legs, or stomach ♥ Feeling more tired ♥ New or unusual coughing ♥ Dizziness ♥ Hard to breathe lying down – need to sleep sitting in chair	♥ Call your doctor or nurse
RED ZONE	♥ Hard time breathing ♥ Struggling to breathe even at rest ♥ Chest pain or discomfort ♥ Feeling faint	♥ Call 911 or ♥ Get help, go to Emergency Room

Figure 2.   Patient symptom monitoring guide. Source: UCONN Health Center.

Transcultural Nursing developed by Madeline Leininger to promote individualized patient education that is unique to the patient's own experience and knowledge (Leininger, 1988).

The theory of Culture Care & Transcultural nursing defines culture as 'learned, shared, and transmitted values, beliefs, norms of a group that influences behavior' (Leininger, 1988). As such, intervention planned considered the patient's cultural background, beliefs and values to encourage active patient engagement and adaptation. Additionally, the delivery method of patient education and patient's response was continuously evaluated to increase patient engagement and promote adherence to treatment plan.

Ethical considerations

The study was approved by the organization's Institutional Review Board and deemed as quality improvement. Expedited approval was granted.

Data collection

Instruments

Conviction and Confidence Scale

Nurses on the designated units were asked to complete an initial Conviction and Confidence Scale. A Conviction and Confidence Scale measures the nurse's belief and confidence level when using teach-back method during patient education. Teach-back method is an educational technique that actively engages patients during nurse education by prompting patients to reiterate their understanding (Agency for Healthcare Research and Quality, 2015; Xu, 2012). Using teach-back method ensures that patients are engaged and assume ownership of their own health (Agency for Healthcare Research and Quality, 2015).

Dutch Heart Failure Knowledge Scale

Patient's heart failure knowledge was measured using Dutch Heart Failure Knowledge Scale (DHFKS). DHFKS is a 15-item multiple choice questionnaire. The DHFKS consists of four questions assessing general knowledge, six questions on diet, fluid restriction and activity, and five questions assessing knowledge regarding symptoms and symptom recognition. Reliability and construct validity was determined by the author, reporting a Cronbach α .62. The scale has a minimum score of 0 and a maximum score of 15 points (van der Wal et al., 2005).

Self-care Heart Failure Index

Self-care behavior was measured using the SCHFI V.6.2, developed by Riegel and colleagues (2009) specifically for use with individuals with heart failure. SCHFI is a 22-item questionnaire that is divided into 3 subscales: self-care maintenance, self-care management, and self-care confidence. Self-care maintenance measures patient's ability to maintain health by adhering to treatment advice and performing tasks such as daily weight, medication adherence and following a low salt diet. Self-care maintenance consists of 10 questions with a minimum score of 10 and maximum score of 40 (Barbaranelli et al., 2014).

Self-care management measures patients' ability to recognize symptoms and perform tasks to manage symptoms as they arise. Self-care management has a minimum score of 4 and maximum score of 24. Self-care confidence measures, patients perceived confidence in recognizing and managing symptoms to maintain health. Self-care confidence has a minimum score of 6 and maximum of 24. Each of the scales use a 4-point Likert scale, self-report reply format: 1(never or rarely), 2 (sometimes), 3 (frequently), 4 (always or daily). A standardized score of 0–100 for each of the sub-scale is used for better interpretation. A score of 70 or greater in each subscale is thought to reflect good self-care behavior. The reliability of the subscales as reported by Riegel is as follows: Self-care maintenance 0.56, self-care management 0.70, and self-care confidence 0.80 (Riegel et al., 2009; Barbaranelli et al., 2014).

Analysis

Data analysis was conducted using SPSS® 24 (IBM Corporation, Armonk, NY, USA). Descriptive statistics were analyzed the characteristics of the demographic for the sample. Frequency

Table 1. Demographic characteristics.

	Mean ± SD
n = 29	
Age	66 ± 11.5
Gender	
Males	15 ± 51.7
Females	14 ± 48.3
Race	
Caucasian	10 ± 34.5
African-American	18 ± 62.1
Hispanic	1 ± 3.4
Marital Status	
Married	7 ± 24.1
Not-married (single, divorced, widowed)	22 ± 75.9
Work	
Employed	11 ± 37.9
Unemployed, retired, disability	18 ± 62.1
NYHA	
Class I	5 ± 17.2
Class II	4 ± 13.8
Class III	8 ± 27.6
Class IV	12 ± 41.4
Ejection Fraction	
=55%	11 ± 37.9
<55%	18 ± 62.1

statistics were analyzed to identify the characteristics of nurse's response to the Conviction and Confidence scale. A paired *t*-test was completed to compare baseline knowledge and self-care scores with the follow-up period at 7, 30, and 90-days post hospitalization. A *p*-value <.05 is considered statistically significant. A Chi-square test was completed to analyze a change in 30-day readmission during the study period, from September 2016 through February 2017 compared to the same time period the year before.

Results

Demographics

Descriptive statistics were used to evaluate frequencies among the *N* = 29 participants (Table 1). Demographic characteristics were collected from medical records and participant interviews. The sample consisted of *n* = 15 (52%) men and *n* = 14 (48%) women admitted to one of the two cardiac inpatient units, with the primary and secondary diagnosis of heart failure. The majority of patients within this sample had a New York Heart Association Classification (NYHA) scores of III-IV (69%), with more that 62% having an ejection fraction of less than 55%. The mean age of participants was 66, ranging from 47 to 90 years of age, with 75% of this group being not married, widowed, or divorced. Sixty-two percent (*n* = 18) of participants identified as African American and *n* = 10 (34%) Caucasian, with one patient reportedly Hispanic. Of the *N* = 29 participants, *n* = 10 were either lost to follow or requested to be removed from the study.

Nurses Conviction and Confidence Score

A sample size of *N* = 23 nurses completed the Confidence and Conviction Scale. Of that one nurse did not complete the educational level and years of experience. From *N* = 22, 81% of nurses (*n* =

Table 2.   Dutch heart failure knowledge scores.

DHFKS	Total sample N = 29 T0 (Baseline)	n = 19 T1 (7 days)	n = 16 T3 (90 days)	T1 to T2 P	T1 to T3 P
DHFKS, mean (SD)	11.965 (1.76)	13.32 (2.08)	13.31 (1.29)	.001**	.032**

Note: *P*-value < .05 is considered statistically significant.
**Statistically significant.

18) had a baccalaureate degree and 59% (*n* = 13) had 1–3 years of experience. Overall, the nurses were convinced that using teach-back method was very important, mean 9.39 ± 0.89, and the nurses reported being confident at using teach back method with mean 7.52 ± 1.78. Approximately 69% of the nurses reported using teach-back method during patient education. Nurses' response to their belief and conviction about using Teach-back method and the length of time they have been using Teach-back method.

Dutch Heart Failure Knowledge Score

The DHFKS was used to evaluate individual knowledge among participants at two points in time evaluating baseline scores from baseline to 7 days and baseline to 90 days. Baseline knowledge scores yielded a statistically significant increase by 1.38 points (*p* = .001) at the 7-day follow-up period. Similar to previous studies, participants in this study had a mean baseline knowledge score of 11.96, out of 15 being the highest achievable score (Dennison et al., 2011; van der Wal et al., 2005). Knowledge scores at the 90-day follow-up period significantly increased and remained higher than baseline knowledge scores by two points (11.96 vs. 13.31; *p* = .032) respectively (Table 2). Based on these results, we can infer that nurse-led heart failure education positively impacts patients' knowledge level about the disease process.

Self-care Heart Failure Index Score

Self-care maintenance scores significantly increased from a mean of 64.59to 85.43 (*p* = .000) and self-care management scores increased from 55.86to 78.68 (*p* = .001) at the 7-day follow-up period. In this study the participants had adequate self-care confidence scores at baseline (>70), but there was no significant difference at the 7-day follow-up in the self-care confidence scores (*p* = .204). There was a statistically significant difference in self-care confidence between at the baseline and 30-day follow-up (*p* = .017). In addition, mean self-care maintenance and self-care management scores were greater than 70 (Table 3).

Table 3.   Mean self-care Heart Failure Index scores.

Mean SCHFI Scores	T0 (Baseline) N = 29	T1 (7-days) N = 19	T2 (30-days) N = 18	T0 to T1 P	T0 to T2 P
SCHFI Maintenance, Mean (SD)	64.59 (17.76)	85.43 (10.32)	89.07 (8.39)	.000**	.000**
SCHFI Management, Mean (SD)	55.86 (15.64)	78.68 (17.15)	76.50 (17.01)	.001**	.013**
SCHFI Confidence, Mean (SD)	71.61 (16.62)	77.84 (17.48)	86.18 (14.18)	.169	.017**

Note: A *P* value <.05 is considered statistically significant.
**Statistically significant.

30-day readmission

Overall the readmission rate for all-cause for this group ($n = 5$) did not change in comparison to the group from the prior year ($n = 12$) at 17%. There was no significant difference in the readmission rates between the two samples.

Discussion

Heart failure is a common condition with a high symptom burden (Albert, 2012). Some of the challenges reported by participants in this study were related to maintaining fluid restrictions; engaging in daily physical activity; and difficulty obtaining a follow-up appointment within the recommended time. As described in the demographic data (Table 1), 41% of the participants had a Class IV NYHA and 62% had an EF ≤ 55% which may have precluded the individuals from engaging in activity and adhering to their appointments as scheduled. Additionally, other co-morbidities that required adequate hydration were competing factors that challenged patients about adhering to fluid restriction. Participants in this study reported adhering to medications and avoiding salty food. However, the attrition rate ($n = 10$) for this study was high (33%) compared to the acceptable rate of about 20% (Amico, 2009). The attrition rate is attributed to death; readmissions for a significant event and a change in discharge destination to a nursing home; participants requesting to be removed from the study; and participants lost to follow-up. Previous study had suggested that a telephone follow-up within 7-days after discharge may improve participation (Baptiste et al., 2016), however, in this study, participants lost to follow-up were observed during the initial follow-up period. Individuals with advanced heart failure may not be able to participate due to fatigue and disease burden (Boisvert et al., 2015). A comparison analysis of the NYHA classification between the participants who completed the study and the attrition rate found that majority of the participants in the attrition group had NYHA class IV classification. Further study is warranted to uncover methods to engage the sicker heart failure patients in self-care behavior.

The population in this study demonstrated an improved knowledge and self-care confidence scores. This is similar to the previous study reported by Liou et al. (2015). At the follow-up period, the study population demonstrated an improvement in knowledge, self-care maintenance, self-care management, and self-care confidence scores. However, the 30-day readmission rate was not statistically significant when compared to the same time period the previous year. This may be due to the small sample size. Further study is warranted on large sample size to see the effect of knowledge and self-care behavior on readmission.

Nurses are in a unique position to influence health behavior by engaging patients during hospitalization (Albert, 2012). Nurses have to feel comfortable and prepared to educate patients. Examination of the nurses' belief and confidence to use teach-back method revealed that the majority of the nurses (70%) reported being comfortable using open-ended questions and engaging patients during health education using teach-back method. Moreover, close to 70% of the nurses reported to using teach-back method and another 22% of the nurses planned to use teach-back method in the next month. Most nurses $n = 23$ (mean 9.39 ± 0.89) responded that they were convinced that using teach-back method is important.

Limitations

There were several limitations in this study. First, this was a non-randomized sample without a control group. Second, it was a convenience sample from two cardiovascular units at a single site. Third, the study is not generalizable due to the small size of the participants. Finally, the study was short in duration, and possibly limited the number of participants.

Implication for practice

This study showed that individualized one-on-one nurse-led heart failure education improved patient's knowledge and self-care maintenance, management, and confidence. It is recommended that hospitals implement a nurse-led heart failure education that encompasses the key factors identified by expert opinions (Yancy et al., 2013). In addition it is recommended that a timely follow-up schedule should be provided to the patient prior to discharge to ease the burden on patients as they are adjusting to their daily routine. Additionally, nurses are encouraged to use evidence-based teaching methods to enhance the patient's comprehension of presented education.

Impact statement

Nurse-led heart failure education can improve knowledge, self-care, and reduce readmissions for individuals with heart failure. Nurses are uniquely qualified to implement such programs that can improve health outcomes and need to accommodate evidence-based recommendations to practice settings across the globe.

Conclusion

It is essential that nurses must feel prepared and knowledgeable on methods to actively engage patients during health education, because, improving knowledge and self-care behavior has demonstrated patient's ability to care for self by taking appropriate actions to minimize disease exacerbation.

Health care providers can alleviate some of the barriers by scheduling follow-up appointments prior to patient's discharge, by discussing how to balance restrictions necessary to maintain free of fluid overload with other co-morbidities that require adequate fluid intake, and by encouraging patients to gradually increase activity level. Challenges incurred during this study were related to the sample size. Nurse researchers can translate findings from this study to clinical practice. The investigation is necessary to explore cost-effective ways to provide education interventions that would improve self-care, knowledge, and minimize readmissions (Toback & Clark, 2017). Further study is needed to look at the effect of improving knowledge and self-care behavior on 30-day readmission.

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